

PROJECT SPECIAL PROVISIONS
ROADWAY 1-15-02

RR01

PRICE ADJUSTMENT - ASPHALT BINDER FOR PLANT MIX: 11-21-00

Price adjustments for asphalt binder for plant mix will be made in accordance with Section 620 of the Standard Specifications as modified herein.

The base price index for asphalt binder for plant mix is \$219.17 per ton.

This base price index represents an average of F.O.B. selling prices of asphalt binder at supplier's terminals on October 1, 2005.

RR19

ASPHALT PAVEMENTS - SUPERPAVE 02-17-04

Revise the 2002 Standard Specifications as follows:

PRIME COAT

Page 6-2, Article 600-9

Delete the first paragraph under this Article and substitute the following:

The quantity of prime coat to be paid will be the number of gallons (liters) of prime coat material that has been satisfactorily placed on the roadway. Each distributor load of prime coat material delivered and utilized on the project will be measured.

ASPHALT TACK COAT

Page 6-4, Article 605-8

Insert the following after paragraph one in this Article:

Take necessary precautions to limit the tracking and/or accumulation of tack coat material on either existing or newly constructed pavements. Excessive accumulation of tack may require corrective measures.

FIELD VERIFICATION AND JOB MIX FORMULA ADJUSTMENTS

Page 6-7, Article 609-4

Delete the first paragraph under this Article and substitute the following:

Conduct field verification of the mix at each plant within 30 calendar days prior to initial production of each mix design, when required by the Allowable Mix Adjustment Policy and when directed as deemed necessary.

Page 6-8, Article 609-4

Delete the first paragraph on this page and substitute the following:

Retain records of these calibrations and mix verification tests, including Superpave Gyratory Compactor (SGC) printouts, at the QC laboratory. In addition, furnish copies, including SGC printouts, to the Engineer for review and approval within one working day after beginning production of the mix.

Page 6-8, Article 609-4

Add the following sentence to the end of the last paragraph in this Article:

Any mix produced that is not verified may be assessed a price reduction at the Engineer's discretion in addition to any reduction in pay due to mix and/or density deficiencies.

Quality control minimum sampling and testing schedule:

Page 6-9, Subarticle 609-5(C)1

Delete the second sentence in the second paragraph of this Article and substitute the following:

Retain the QC compacted volumetric test specimens for 5 calendar days, commencing the day the specimens are prepared.

Page 6-9, Subarticle 609-5(C)2

At the bottom of this page, delete the sentence directly above the Accumulative Production Increment and substitute the following:

Sample and test the completed mixture from each mix design at the following minimum frequency during mix production:

Page 6-10, Subarticle 609-5(C)2

Revise Items B, C, D and E on this page as follows:

- B. Gradation on Recovered Blended Aggregate from Mix Sample (AASHTO T 30 Modified) Grade on all sieves specified on JMF
- C. Maximum Specific Gravity (AASHTO T 209 or ASTM D 2041), optional (ASTM D 6857)
- D. Bulk Specific Gravity of Compacted Specimens (AASHTO T166), optional (ASTM D 6752), Average of 3 specimens at N_{des} gyrations (AASHTO T 312)
- E. Air Voids (VTM) (AASHTO T 269), Average of 3 specimens at N_{des} gyrations

Page 6-11, Subarticle 609-5(C)2

At the top of this page, delete Item B., "Reclaimed Asphalt Pavement..." and substitute the following:

- B. Reclaimed Asphalt Pavement (RAP) Binder Content and Gradation (AASHTO T 308 Modified or T 164 and AASHTO T 30 Modified) (sampled from stockpiles or cold feed system at beginning of production and weekly thereafter). Have RAP approved for use in accordance with Article 1012-1(G). (Split Sample Required)

Page 6-11, Subarticle 609-5(C)2

Insert the following sampling and testing at the end of this Subarticle

- F. Uncompacted Void Content of Fine Aggregate, AASHTO T 304, Method A (natural sand only). Performed at Mix Design and when directed as deemed necessary. (Split Sample Required)
- G. Reclaimed Asphalt Shingle Material (RAS) Binder Content and Gradation (AASHTO T 308 Modified or T 164 and AASHTO T 30 Modified) (sampled from stockpiles or cold feed system at beginning of production and weekly thereafter). Have RAS approved for use in accordance with Article 1012-1(F). (Split Sample Required)

CONTROL CHARTS

Page 6-11, Subarticle 609-5(C)3

Delete the second sentence of the first paragraph in this Subarticle and substitute the following:

Record all regularly scheduled random sample or directed sample full test series results for mix incorporated into the project on control charts the same day the test results are obtained.

Page 6-12, Subarticle 609-5(C)3

Delete item 3 in the list below the second full paragraph on this page.

CONTROL LIMITS

Page 6-12, Subarticle 609-5(C) 4

At the bottom of this page, delete the table and substitute the following:

CONTROL LIMITS				
Mix Control Criteria	Target Source	Warning Limit	Moving Average Limit	Individual Limit
2.36mm Sieve	JMF	±4.0 %	±5.0 %	±8.0 %
0.075mm Sieve	JMF	±1.5 %	±2.0 %	±2.5 %
Binder Content	JMF	±0.3 %	±0.5 %	±0.7 %
VTM @ N _{des}	JMF	±1.0 %	±1.5 %	±2.0 %
VMA @ N _{des}	Min. Spec. Limit	-0.5%	-0.8%	-1.0%
P _{0.075} / P _{be} Ratio	Max. Spec. Limit	0.0	N/A	+0.4%
%G _{mm} @ N _{ini}	Max. Spec. Limit	N/A	N/A	+2.0%
TSR	Min. Spec. Limit	N/A	N/A	-15.0%

FIELD COMPACTION QUALITY CONTROL

Page 6-15, Subarticle 609-5(D)1

Delete the first and second sentences in the fourth paragraph on this page and substitute the following:

Base and intermediate mix types (surface mixes not included) utilized for pavement widening of less than 4.0 feet and all mix types used in tapers, irregular areas and intersections (excluding full width travel lanes of uniform thickness), will not be subject to the sampling and testing frequency specified above provided the pavement is compacted using approved equipment and procedures. However, the Engineer may require occasional density sampling and testing to evaluate the compaction process.

Page 6-16, Subarticle 609-5(D)1

Delete item number 2 at the top of this page. Item number 3 should be re-numbered as 2 after the specified deletion.

LIMITED PRODUCTION PROCEDURE

Page 6-17, Subarticle 609-5(D) 5

Delete the first paragraph in this Subarticle and substitute the following:

Proceed on limited production when, for the same mix type, one of the following items occur:

- (1) Two consecutive failing lots, excluding lots representing an individual resurfacing map or portion thereof.
- (2) Three consecutive failing lots, with each lot representing an individual resurfacing map or portion thereof.
- (3) Two consecutive failing nuclear control strips.

Pavement within each construction category (New and Other), as defined in Article 610-13, and pavement placed simultaneously by multiple paving crews will be evaluated independently for limited production purposes.

Delete the first sentence in the last paragraph in this Subarticle and substitute the following:

If the Contractor does not operate by the limited production procedures as specified above, the two consecutive failing density lots, three consecutive failing lots with each lot representing an individual resurfacing map or portion thereof, or two consecutive failing nuclear control strips, whichever is applicable, and all mix produced thereafter will be considered unacceptable.

DOCUMENTATION (RECORDS)

Page 6-18, Subarticle 609-5(E)

Delete the third and fourth sentence in the first full paragraph on this page and substitute the following:

Maintain all QC records, forms and equipment calibrations for a minimum of 3 years from their completion date.

Delete the second full paragraph on this page and substitute the following:

Falsification of test results, documentation of observations, records of inspection, adjustments to the process, discarding of samples and/or test results, or any other deliberate misrepresentation of the facts will result in the revocation of the applicable person's QMS certification. The Engineer will determine acceptability of the mix and/or pavement represented by the falsified results or documentation. If the mix and/or pavement in question is determined to be acceptable, the Engineer may allow the mix to remain in place at no pay for the mix, asphalt binder and other mix components. If the mix and/or pavement represented by the falsified results is determined not to be acceptable, remove and replace with mix, which complies with the Specifications. Payment will be made for the actual quantities of materials required to replace the falsified quantities, not to exceed the original amounts.

QUALITY ASSURANCE

Page 6-18, Article 609-6

In Item 5 under Plant Mix Quality Assurance, add “at a frequency equal to or greater than 5% of the QC sample frequency”.

In the first sentence within the paragraph below Plant Mix Quality Assurance, delete the words “of mix”.

In Item 1 under Density Quality Assurance, delete the wording at the end of the sentence “at a frequency equal to or greater than 10% of the frequency required of the Contractor”.

Page 6-19, Article 609-6

In Item 4 under Density Quality Assurance, add “at a frequency equal to or greater than 5% of the QC sample frequency.”

Insert the following after Item 4 under Density Quality Assurance:

6. By periodically directing the recalculation of random numbers for the Quality Control core or nuclear density test locations. The original QC test locations may be tested by QA and evaluated as verification tests.

LIMITS OF PRECISION

Page 6-19, Article 609-6

In the limits of precision table, delete the last three rows and substitute the following:

QA retest of prepared QC Gyratory Compacted

Volumetric Specimens	± 0.015
Retest of QC Core Sample	± 1.2% (% Compaction)
Comparison of QA Core Sample	± 2.0% (% Compaction)
QA Verification Core Sample	± 2.0% (% Compaction)
Nuclear Comparison of QC Test	± 2.0% (% Compaction)
QA Nuclear Verification Test	± 2.0% (% Compaction)

ASPHALT CONCRETE PLANT MIX PAVEMENTS – DESCRIPTION

Page 6-20, Article 610-1

Insert the following after the last paragraph in this Article:

A high frequency of asphalt plant mix, density, or mix and density deficiencies occurring over an extended duration of time may result in future asphalt, which is represented by mix and/or density test results not in compliance with minimum specification requirements, being excluded

from acceptance at an adjusted contract unit price in accordance with Article 105-3. This acceptance process may apply to all asphalt produced and /or placed and may continue until the Engineer determines a history of quality asphalt production and placement is reestablished.

MATERIALS

Page 6-21, Article 610-2

Delete reference of Anti-strip additive (chemical) to Article 1020-2 and substitute Article 1020-8.

COMPOSITION OF MIXTURES (MIX DESIGN AND JOB MIX FORMULA)

Page 6-21, Subarticle 610-3(A)

At the end of the second paragraph under this Subarticle, add the following sentence:

In addition, submit Superpave gyratory compactor printouts for all specimens compacted at N_{des} and N_{max} during the mix design process.

Insert the following paragraph after the second paragraph under this Subarticle:

For the final surface layer of the specified mix type, use a mix design with an aggregate blend gradation above the maximum density line on the 2.36 mm and larger sieves.

Insert the following at the end of the third paragraph under this Article:

When the percent of binder contributed from RAS or a combination of RAS and RAP exceeds 20 percent of the total binder in the completed mix, the virgin binder PG grade must be one grade below (both high and low temperature grade) the binder grade specified in Table 610-2 for the mix type.

Delete the fourth paragraph in this Subarticle and substitute the following:

For Type S 12.5D mixes, the maximum percentage of reclaimed asphalt material is limited to 15% and must be produced using virgin asphalt binder grade PG 76-22. For all other recycled mix types, when the percentage of RAP is 15 percent or less of the total mixture, the virgin binder PG grade must be as specified in Table 610-2 for the specified mix type. When the percentage of RAP is greater than 15 but not more than 25 percent of the total mixture, the virgin binder PG grade must be one grade below (both high and low temperature grade) the specified grade for the mix type. When the percentage of RAP is greater than 25 percent of the total mixture, the Engineer will establish and approve the asphalt binder grade.

Page 6-22, Subarticle 610-3(A)

Insert the following sentence at the end of the Item 4:

If natural sand is utilized in the proposed mix design, determine and report the Uncompacted Void Content of the natural sand in accordance with AASHTO T-304, Method A.

Page 6-23, Subarticle 610-3(A)

Under the quantities of mix components insert the following sentence:

When requested by the Engineer, submit to the Department's Materials and Tests Unit, in Raleigh, six (6) Superpave Gyratory Compactor specimens compacted to a height of 75 mm and to a void content (VTM) of 4.0% +/- 0.5% for performance rut testing with the Asphalt Pavement Analyzer.

JOB MIX FORMULA

Page 6-24, Subarticle 610-3(C)

Delete Table 610-1 and associated notes. Substitute the following:

TABLE 610-1
SUPERPAVE AGGREGATE GRADATION DESIGN CRITERIA

Standard Sieves	Percent Passing Criteria (Control Points)											
	Mix Type (Nominal Maximum Aggregate Size)											
	4.75 mm (a)		9.5 mm (c)		12.5 mm (c)		19.0 mm		25.0 mm		37.5 mm	
(mm)	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
50.0												100.0
37.5										100.0	90.0	100.0
25.0								100.0	90.0	100.0		90.0
19.0						100.0	90.0	100.0		90.0		
12.5				100.0	90.0	100.0		90.0				
9.5		100.0	90.0	100.0		90.0						
4.75	90.0	100.0		90.0								
2.36	65.0	90.0	32.0(b)	67.0(b)	28.0	58.0	23.0	49.0	19.0	45.0	15.0	41.0
1.18												
0.600												
0.300												
0.150												
0.075	4.0	8.0	4.0	8.0	4.0	8.0	3.0	8.0	3.0	7.0	3.0	6.0

- (a) For Type S 4.75A, a minimum of 50% of the aggregate components shall be manufactured material from the crushing of stone.
- (b) For Type SF 9.5A, the percent passing the 2.36mm sieve shall be a minimum of 60% and a maximum of 70%.
- (c) For the final surface layer of the specified mix type, use a mix design with an aggregate blend gradation above the maximum density line on the 2.36 mm and larger sieves.

Page 6-25, Subarticle 610-3(C),

Delete Table 610-2 and associated notes. Substitute the following:

TABLE 610-2
SUPERPAVE MIX DESIGN CRITERIA

Mix	Design ESALs	Binder PG	Compaction Levels			Volumetric Properties (c)			
Type	millions	Grade	No. Gyration @			VMA	VTM	VFA	%Gmm
(f)	(a)	(b)	N _{ini}	N _{des}	N _{max}	% Min.	%	Min. - Max.	@ N _{ini}
S-4.75A	<0.3	64 -22	6	50	75	20.0	7.0-15.0		
SF-9.5A	<0.3	64 -22	6	50	75	16.0	3.0 - 5.0	70 - 80	≤ 91.5
S-9.5B	0.3 - 3	64 -22	7	75	115	15.0	3.0 - 5.0	65 - 80	≤ 90.5
S-9.5C	3 - 30	70 -22	8	100	160	15.0	3.0 - 5.0	65 - 76	≤ 90.0
S-12.5C	3 - 30	70 -22	8	100	160	14.0	3.0 - 5.0	65 - 75	≤ 90.0
S-12.5D	> 30	76 -22	9	125	205	14.0	3.0 - 5.0	65 - 75	≤ 90.0
I-19.0B	< 3	64 -22	7	75	115	13.0	3.0 - 5.0	65 - 78	≤ 90.5
I-19.0C	3 - 30	64 -22	8	100	160	13.0	3.0 - 5.0	65 - 75	≤ 90.0
I-19.0D	> 30	70 -22	9	125	205	13.0	3.0 - 5.0	65 - 75	≤ 90.0
B-25.0B	< 3	64 -22	7	75	115	12.0	3.0 - 5.0	65 - 78	≤ 90.5
B-25.0C	> 3	64 -22	8	100	160	12.0	3.0 - 5.0	65 - 75	≤ 90.0
B-37.5C	> 3	64 -22	8	100	160	11.0	3.0 - 5.0	63 - 75	≤ 90.0
	Design Parameter					Design Criteria			
All	1. %G _{mm} @ N _{max}					≤ 98.0% (d)			
Mix	2. Dust to Binder Ratio (P _{0.075} / P _{be})					0.6 - 1.4			
Types	3. Retained Tensile Strength (TSR) (AASHTO T 283 Modified)					85 % Min. (e)			

- Notes:**
- (a) Based on 20 year design traffic.
 - (b) When Recycled Mixes are used, select the binder grade to be added in accordance with Subarticle 610-3(A).
 - (c) Volumetric Properties based on specimens compacted to N_{des} as modified by the Department.
 - (d) Based on specimens compacted to N_{max} at selected optimum asphalt content.
 - (e) AASHTO T 283 Modified (No Freeze-Thaw cycle required). TSR for Type S 4.75A, Type B 25.0 and Type B 37.5 mixes is 80% minimum.
 - (f) Mix Design Criteria for Type S 4.75A may be modified subject to the approval of the Engineer

WEATHER, TEMPERATURE, AND SEASONAL LIMITATIONS FOR PRODUCING AND PLACING ASPHALT MIXTURES

Page 6-26, Article 610-4, Table 610-3

Delete the title of Table 610-3 and substitute the following title:

ASPHALT PLACEMENT- MINIMUM TEMPERATURE REQUIREMENTS

In the first column, third row; delete reference to the ACSC Types S 9.5A and S 12.5B mix.

Add the following minimum placing temperatures for mix types S 4.75A and SF 9.5A.

Asphalt Concrete Mix Type	Minimum Air Temperature	Minimum Road Surface Temperature
ACSC, Type S 4.75A, SF 9.5A	40°F (5°C)	50°F (10°C)

SPREADING AND FINISHING

Page 6-32, Article 610-8

Insert the following after the second sentence within the sixth paragraph in this Article,

Take necessary precautions during production, loading of trucks, transportation, truck exchanges with paver, folding of the paver hopper wings, and conveying material in front of the screed to prevent segregation of the asphalt mixtures.

Page 6-33, Article 610-8

At the end of the third full paragraph on this page, add the following sentence:

Waiver of the use of automatic screed controls does not relieve the Contractor of achieving plan grades and cross-slopes.

DENSITY REQUIREMENTS

Page 6-34, Article 610-10,

Delete Table 610-4 and substitute the following table and associated notes:

Table 610-4
MINIMUM DENSITY REQUIREMENTS

MIX TYPE	MINIMUM % of G_{mm}
SUPERPAVE MIXES	(Maximum Specific Gravity)
S 4.75A	85.0 ^(a,b)
SF 9.5A	90.0
S 9.5X, S 12.5X, I 19.0X, B 25.0X, B 37.5X	92.0

(a) All S 4.75A pavement will be accepted for density in accordance with Article 105-3

(b) Compaction to the above specified density will be required when the S 4.75 A mix is applied at a rate of 100 lbs/sy (55 kg/m²)

Page 6-34, Article 610-10

Delete the second paragraph in this Article and substitute the following:

Compact base and intermediate mix types (surface mixes not included) utilized for pavement widening of less than 4.0 feet (1.2 meters) and all mix types used in tapers, irregular areas and intersections (excluding full width travel lanes of uniform thickness), using equipment and procedures appropriate for the pavement area width and/or shape. Compaction with equipment other than conventional steel drum rollers may be necessary to achieve adequate compaction. Occasional density sampling and testing to evaluate the compaction process may be required. Densities lower than that specified in Table 610-4 will be accepted, in accordance with Article 105-3, for the specific mix types and areas listed directly above.

SURFACE REQUIREMENTS AND ACCEPTANCE

Page 6-35, Article 610-12

Delete the first paragraph in this Article and substitute the following:

Construct pavements using quality paving practices as detailed herein. Construct the pavement surface smooth and true to the plan grade and cross slope. Immediately correct any defective areas with satisfactory material compacted to conform with the surrounding area. Pavement imperfections resulting from unsatisfactory workmanship such as segregation, improper longitudinal joint placement or alignment, non-uniform edge alignment and excessive pavement repairs will be considered unsatisfactory and if allowed to remain in place will be accepted in accordance with Article 105-3.

When directed due to unsatisfactory laydown or workmanship, operate under the limited production procedures. Limited production for unsatisfactory laydown is defined as being restricted to the production, placement, compaction, and final surface testing (if applicable) of a sufficient quantity of mix necessary to construct only 2500 feet (750 meter) of pavement at the laydown width.

Remain on limited production until such time as satisfactory laydown results are obtained or until three consecutive 2500 foot (750 meter) sections have been attempted without achieving satisfactory laydown results. If the Contractor fails to achieve satisfactory laydown results after three consecutive 2500 foot (750 meter) sections have been attempted, cease production of that mix type until such time as the cause of the unsatisfactory laydown results can be determined. As an exception, the Engineer may grant approval to produce a different mix design of the same mix type if the cause is related to mix problem(s) rather than laydown procedures.

Mix placed under the limited production procedures for unsatisfactory laydown or workmanship will be evaluated for acceptance in accordance with Article 105-3.

DENSITY ACCEPTANCE

Page 6-36, Article 610-13

Delete the second paragraph on this page and substitute the following:

The pavement will be accepted for density on a lot by lot basis. A lot will consist of one day's production of a given job mix formula on a contract. As an exception, separate lots will be established when the one of the following occurs:

- (6) Portions of pavement are placed in both "New" and "Other" construction categories as defined below. A lot will be established for the portion of the pavement in the "New" construction category and a separate lot for the portion of pavement in the "Other" construction category.
- (7) Pavement is placed on multiple resurfacing maps, unless otherwise approved prior to paving. A lot will be established for each individual resurfacing map or portion thereof.
- (8) Pavement is placed simultaneously by multiple paving crews. A lot will be established for the pavement placed by each paving crew.
- (9) Pavement is placed in different layers. A lot will be established for each layer.
- (10) Control strips are placed during limited production.

The Engineer will determine the final category and quantity of each lot for acceptance purposes.

Page 6-36, Article 610-13

Delete the first sentence in the third paragraph on this page and insert the following:

The “New” construction category will be defined as pavements of uniform thickness, exclusive of irregular areas, meeting all three of the following criteria:

Delete the sixth paragraph in this Article and substitute the following:

A failing lot for density acceptance purposes is defined as a lot for which the average of all test sections, and portions thereof, fails to meet the minimum specification requirement. If additional density sampling and testing, beyond the minimum requirement, is performed and additional test sections are thereby created, then all test results shall be included in the lot average. In addition, any lot or portion of a lot that is obviously unacceptable will be rejected for use in the work.

Page 6-36, Article 610-13

Delete the last paragraph on this page and substitute the following:

Any density lot not meeting minimum density requirements detailed in Table 610-4 will be evaluated for acceptance by the Engineer. If the lot is determined to be reasonably acceptable, the mix will be paid at an adjusted contract price in accordance with Article 105-3. If the lot is determined not to be acceptable, the mix will be removed and replaced with mix meeting and compacted to the requirement of these specifications.

BASIS OF PAYMENT, ASPHALT PAVEMENTS

Page 6-37, Article 610-16

Add the following to the second paragraph:

The quantity of hot mix asphalt pavement, measured as provided in Article 610-15, will be paid for at the contract unit prices per ton (metric ton) for “Asphalt Concrete Surface Course, Type S 4.75A, and SF 9.5A”.

Add the following to the payment item description:

Asphalt Concrete Surface Course, Type S 4.75A.....	Ton (Metric Ton)
Asphalt Concrete Surface Course, Type SF 9.5A.....	Ton (Metric Ton)

Delete reference to the Asphalt Concrete Surface Course, Types S 9.5A and S 12.5B in both the second paragraph and in the payment description.

ASPHALT BINDER FOR PLANT MIX - METHOD OF MEASUREMENT

Page 6-39, Article 620-4

Delete the first sentence of the second paragraph on this page and substitute the following:

Where recycled plant mix is being produced, the grade of asphalt binder to be paid for will be the grade for the specified mix type as required in Table 610-2 unless otherwise approved.

CONSTRUCTION REQUIREMENTS

Page 6-43, Article 650-5

Add the following paragraph after the first paragraph under this Article:

Do not place open-graded asphalt friction course between October 31 and April 1 of the next year, unless otherwise approved. Place friction course, Type FC-1 mixes, only when the road surface temperature is 50°F (10°C) or higher and the air temperature is 50°F (10°C) or higher. The minimum air temperature for Type FC-1 Modified and FC-2 Modified mixes will be 60°F (15°C).

AGGREGATES FOR ASPHALT PLANT MIXES

Page 10-34, Subarticle 1012-1(B)4

Delete this Subarticle and substitute the following:

(4) Flat and Elongated Pieces:

Use coarse aggregate meeting the requirements of Table 1012-1 for flat and elongated pieces when tested in accordance with ASTM D 4791 (Section 8.4) on the No. 4 (4.75 mm) sieve and larger with a 5:1 aspect ratio (maximum to minimum) for all pavement types, except there is no requirement for Types S 4.75A, SF 9.5A, and S 9.5B.

Page 10-35, Table 1012-1

Delete Table 1012-1 and substitute the following:

Table 1012-1
AGGREGATE CONSENSUS PROPERTIES^(a)

Mix Type	Course Aggregate Angularities ^(b)	Fine Aggregate Angularities % Minimum	Sand Equivalent % Minimum	Flat & Elongated 5 : 1 Ratio % Maximum
	ASTM D 5821	AASHTO T 304 Method A	AASHTO T 176	ASTM D 4791 Section 8.4
S 4.75 A		40	40	
SF 9.5 A S 9.5 B I 19.0 B B 25.0 B	75 / -	40	40	10 ^(c)
S 9.5 C S 12.5 C I 19.0 C B 25.0 C B 37.5 C	95 / 90	45	45	10
S 12.5 D I 19.0 D	100 / 100	45	50	10
OGAFC	100 / 100	N/A	N/A	10

(a) Requirements apply to the course aggregate blend and/or fine aggregate blend

(b) 95/90 denotes that 95% of the course aggregate (+No.4 or + 4.75mm sieve) has one fractured face and 90% has two or more fractured faces.

(c) Does not apply to Mix Types SF 9.5 A or S 9.5 B

Page 10-36, Subarticle 1012-1(C)1

Insert the following after the fourth paragraph on this page:

When natural sand is utilized in “C” or “D” level asphalt mixes, do not exceed the maximum natural sand percentage in the mix design and/or production aggregate blend detailed in Table 1012-1A.

Table 1012-1A

Uncompacted Void Content of Fine Aggregate AASHTO T 304 Method A	Maximum Percent Natural Sand Included in Mix Design and/or Production*
Less than 42.0	10
Equal to 42.0 to 44.9	15
Equal to 45.0 and greater	20

*Maximum percent natural sand may be exceeded with approval from Pavement Construction Engineer upon satisfactory evaluation of pavement performance testing

FINE AGGREGATE ANGULARITY

Page 10-36, Subarticle 1012-1(C)6

Delete reference to AASHTO TP 33 Method A and substitute AASHTO T 304, Method A.

Page 10-37, Subarticle 1012-1(H)

Delete this Subarticle. It is a duplicate of Subarticle 1012-1(F) located on Page 10-36.

ASPHALT BINDER

Page 10-46, Article 1020-2

Delete the first paragraph under this Article and substitute the following:

Use Performance Graded Asphalt Binder meeting the requirements of AASHTO M 320. See Article 610-3 for the specified grades. Submit a Quality Control Plan for asphalt binder production in conformance with the requirements of AASHTO R 26 to the Materials and Tests Unit.

RR31

ULTRA-THIN BONDED WEARING COURSE:

11-01-2004

DESCRIPTION:

The work covered by this specification consists of the production and placement of an Ultra-thin Bonded Wearing Course (UBWC) and shall include the application of a warm Polymer-Modified Emulsion Membrane (PMEM) followed immediately with an Ultra-thin Bonded Wearing Course hot mix asphalt overlay. The polymer-modified emulsion membrane shall be spray applied immediately prior to the application of the hot mix asphalt overlay so as to produce a homogeneous wearing surface that can be opened to traffic immediately after rolling and upon sufficient cooling.

MATERIALS:**AGGREGATE:****A. General Requirements For Aggregate:**

All aggregates, both coarse and fine, shall meet the applicable requirements of Section 1005 and Section 1012 of the Standard Specifications, except as modified herein.

Aggregates produced from crystalline limestone, crystalline-dolomitic limestone, or marble shall not be used in the production of Ultra-thin Bonded Wearing Course. Reclaimed asphalt pavement materials shall not be used in the production of Ultra-thin Bonded Wearing Course. Reclaimed asphalt shingle material, up to 6% by weight of total mix, may be used, subject to approval by the Engineer. Documentation that the asphalt binder grade meets the requirements may be required.

B. Coarse Aggregate:

Coarse aggregates used shall be from approved sources and shall meet the requirements of Table 1005-1 of the Standard Specifications, except as modified herein or unless otherwise approved by the Engineer.

Coarse aggregates, such as crushed gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, or blends of two or more of the above may be acceptable. When coarse aggregates for these mixes are from more than one source or of more than one type of material, they shall be proportioned and blended to provide a uniform mixture, subject to approval by the Engineer. The coarse aggregates selected should be those typically used for high performance surfaces. Coarse aggregates should meet the skid resistance criteria as set forth by the Department and have a history of successful use in surface mixes for the intended traffic level.

Coarse aggregate material retained above the No. 4 sieve shall be from approved sources and shall meet the requirements listed in Table 1 below.

<u>TABLE 1 - COARSE AGGREGATE – PROPERTIES</u>		
Tests	Method	Limit
Los Angeles abrasion value, % loss	AASHTO T 96	35 max
Soundness, % loss, Sodium Sulfate	AASHTO T 104	15 max
Flat & Elongated Ratio, 5:1, + No 4 (4.75 mm)	ASTM D 4791	10 % max
% Crushed, single face	ASTM D 5821	100 min
% Crushed, two or more mechanically crushed faces	ASTM D 5821	85 min
Micro-Deval, % loss	AASHTO TP 58-02	18 max

C. Fine Aggregate:

The fine aggregate passing the No. 4 sieve shall be from approved sources and shall meet the requirements of Table 2 below.

<u>TABLE 2 - FINE AGGREGATE – PROPERTIES</u>		
Tests	Method	Limit
Sand Equivalent	AASHTO T 176	45 min
Uncompacted Void Content	AASHTO T 304	40 min

D. Mineral Filler:

When needed, hydrated lime, certain classes of fly ash, baghouse fines and Type 1 Portland Cement are acceptable as mineral filler. Mineral filler shall conform to the requirements of AASHTO M 17.

POLYMER-MODIFIED EMULSION MEMBRANE:

The Polymer-Modified Emulsion Membrane shall be a styrene-butadiene block co-polymer (SBS) modified asphalt emulsion. The purpose of the membrane is to form a water impermeable seal at the existing pavement surface and to bond the new hot mix to the existing surface. Polymer modification of the base asphalt shall be completed prior to emulsification. The emulsion shall be smooth and homogeneous and conform to the following requirements:

<u>Test On Emulsion</u>	<u>Method</u>	<u>Min.</u>	<u>Max.</u>
Viscosity @ 77°F, SSF	AASHTO T 59	20	100
Sieve Test, %	AASHTO T 59		0.1
24-Hour Storage Stability, % ⁽¹⁾	AASHTO T 59		1
Residue from Distillation @ 400°F, % ⁽²⁾	AASHTO T 59	63	

Oil portion from distillation			
ml of oil per 100 g emulsion			2
Demulsibility	AASHTO T 59	60	
35 ml, 0.02 N CaCl ₂ or			
35 ml, 0.8 % dioctyl sodium sulfosuccinate			

Test On Residue From Distillation

Solubility in TCE, % ⁽³⁾	AASHTO T 44	97.5	
Elastic Recovery, 50°F,			
20 cm elongation % ⁽⁴⁾	AASHTO T 301	60	
Penetration @ 77°F, 100 g, 5 sec, dmm	AASHTO T 49	60	150

- (1) After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.
- (2) AASHTO T-59 with modifications to include a 400°F ± 10°F maximum temperature to be held for a period of 15 minutes.
- (3) ASTM D 5546, Test Method for Solubility of Polymer-Modified Asphalt Materials in 1,1,1-Trichloroethane may be substituted where polymers block the filter in Method D 2042.
- (4) ASTM D 6084, Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer with exception that the elongation is 20 cm and the test temperature is 50°F.

ASPHALT BINDER FOR PLANT MIX, GRADE PG 70-28:

Asphalt binder shall conform to the requirements of Section 620 and Section 1020 of the Standard Specification except as modified herein. The asphalt binder shall be a polymer modified Performance Graded PG 70-28, conforming to the requirements of AASHTO M 320 and as specified below, unless otherwise approved by the engineer. The asphalt binder shall be compatible with the PMEM and existing pavement. Modification to the binder shall be done with SBS, SB, or SBR polymer. Air blown asphalt is not permitted. Modification, testing, and certification of the asphalt binder shall be performed prior to delivery to the asphalt plant. Actual test results will be available to the Engineer prior to use.

In addition to the requirements of AASHTO M 320, the PG 70-28 asphalt binder shall meet the following criteria:

<u>Test on Binder</u>	<u>Method</u>		
Separation of Polymer, %	ASTM D5892	Report	10
<u>Tests On Residue From RTFO Test</u>			
Elastic Recovery, %	ASTM D 6084	Minimum	60

ANTI-STRIP ADDITIVE:

Anti-strip Additive shall meet the requirements of Articles 1020-8 or Article 1012-1(E) and shall be used in accordance with Article 620-3 of the Standard Specifications.

COMPOSITION OF MIX:

The ultra-thin bonded wearing course shall be composed of a mixture of coarse and fine aggregate, asphalt binder, mineral filler, and other additives when required. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading and physical requirements of TABLE 3 of these specifications for the specified mix type. The mix design and optimum asphalt content shall be performed in accordance with the "Ultra-thin Bonded Wearing Course Mix Design Guidelines" on file with the Department's Materials & Test Unit. Copies are available upon request. Materials which will not produce a mixture within the mix design criteria required by these specifications will be rejected, unless otherwise approved by the Engineer.

At least 10 days prior to start of asphalt mix production, the Contractor shall submit in writing a mix design and proposed job mix formula (JMF) targets for each required mix type and combination of aggregates to the Engineer for review and approval. The mix design and proposed job mix formula targets shall be submitted on forms and in a format approved by the Department and applicable requirements of Article 610-3 of the Standard Specifications.

The job mix formula target values will be established within the mix design criteria specified in TABLE 3 for the particular type mixture to be produced. The formula for each mixture will indicate the blend percentage of each aggregate fraction to be used, a single percentage of combined aggregate passing each required sieve size, the percentage and grade of asphalt binder (by weight of total mixture) to be incorporated into the mixture, the percentage of anti-strip additive to be added to the asphalt binder, and the temperature at which the mixture is to be discharged from the plant.

The Contractor shall have on hand at the asphalt plant the approved mix design and job mix formula issued by the Department, prior to beginning the work.

The job mix formula for each mixture shall remain in effect until modified in writing by the Engineer, provided the results of QMS tests performed on material currently being produced conform with specification requirements.

Should a change in sources of aggregate materials to be made, a new mix design and job mix formula will be required before the new mixture is produced.

When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

The Contractor shall determine and certify compatibility of all asphalt emulsion, asphalt binder, and aggregate components.

TABLE 3 – MIXTURE DESIGN CRITERIA				
Gradation Design Criteria (% Passing by Weight)				
SIEVES		1/2 in. Type A	3/8 in. Type B	1/4Type C
ASTM	mm			
3/4 inch	19.0	100		
1/2 inch	12.5	85 - 100	100	
3/8 inch	9.5	60 - 80	85 - 100	100
#4	4.75	28 - 38	28 - 42	40 - 55
#8	2.36	19 - 32	19 - 32	22 - 32
#16	1.18	15 - 23	15 - 23	15 - 25
#30	0.600	10 - 18	10 - 18	10 - 18
#50	0.300	8 - 13	8 - 13	8 - 13
#100	0.150	6 - 10	6 - 10	6 - 10
#200	0.075	4.0 - 7.0	4.0 - 7.0	4.0 - 7.0
MIX DESIGN CRITERIA				
Asphalt Content, %		4.6 - 5.6	4.6 - 5.8	5.0 - 5.8
Draindown Test, AASHTO T 305		0.1% max		
Moisture Sensitivity, AASHTO T 283*		80% min		
Application Rate, lb/ yd ²		90	70	50
Approximate Application Depth, in. (mm)		3/4 (19)	5/8 (16)	1/2(12.5)
Asphalt PG Grade, AASHTO M 320		PG 70-28	PG 70-28	PG 70-28

NOTE: *Specimens for T-283 testing are to be compacted using the Superpave gyratory compactor. The mixtures are to be compacted using 100 gyrations to achieve specimens approximately 95 mm in height. Mixture and compaction temperatures as recommended by the binder supplier.

CONSTRUCTION DETAILS:

A. Equipment:

The contractor shall use a paver designed and built for the purpose of applying Ultra-thin Bonded Wearing Course and approved by the Department. The paver shall be a self-priming paving machine capable of spraying the Polymer-Modified Emulsion Membrane, applying the hot asphalt concrete overlay and screeding the surface of the mat to the required profile and cross- section in one pass at any rate between 30 to 92 ft/minute (10-30 m/minute). The paving machine shall incorporate a receiving hopper, feed conveyor, storage tank for Polymer-Modified

Emulsion Membrane material, Polymer-Modified Emulsion Membrane emulsion single variable-width spray bar and a variable width, heated, vibratory-tamping bar screed. The screed shall have the ability to be crowned at the center both positively and negatively and have vertically and horizontally adjustable extensions to accommodate the desired pavement profile and widths. The sprayer system shall be capable of accurately and continuously monitoring the rate of spray and providing a uniform application across the entire width to be overlaid.

Compaction of the wearing course shall be performed with a steel double drum asphalt roller(s) with a minimum weight of 10 tons. Roller(s) shall be well maintained, in reliable operating condition and be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. Adequate roller units shall be supplied so the compaction will be accomplished promptly following the placement of the material.

Requests for approval of equipment shall be made to the State Pavement Construction Engineer or his Representative prior to the start of any work. All other required equipment and tools shall be approved by the Engineer. All equipment and tools shall be maintained in satisfactory working condition at all times.

B. Surface Preparation:

The following items will be performed prior to the commencement of paving operations and paid for under the appropriate item numbers when included in the contract.

1. Manhole covers, drains, grates catch basins and other such utility structures shall be protected and covered with plastic or building felt prior to paving and also shall be clearly referenced for location and adjustment after paving.
2. Thermoplastic traffic markings symbols, characters, or other markings greater than $\frac{1}{4}$ inch in thickness on the existing pavement shall be removed.
3. Pavement cracks and joints greater than $\frac{1}{4}$ inch (6.3 mm) wide shall be cleaned and completely filled, leaving no more than a 2 inch overband and no thicker than $\frac{1}{4}$ inch over the existing pavement. The sealant will be applied per manufacturer's recommendation and approved by the Engineer.
4. Surface irregularities greater than 1" (25 mm) deep shall be filled with a material approved by the Engineer.
5. The entire pavement surface to be overlaid shall be thoroughly cleaned, giving specific attention to accumulated mud and debris. Pressurized water and/or vacuum systems may be required to ensure a clean surface.

C. Application of Ultra-thin Bonded Wearing Course:

Ultra-thin Bonded Wearing Course shall not be placed between October 31 and April 1. The pavement surface temperature shall be not less than 50°F (10°C) at the time of placement. The Ultra-thin Bonded Wearing Course shall not be placed on a wet pavement. A damp pavement surface is acceptable for placement if it is free of standing water and favorable weather conditions are expected to follow.

The Ultra-thin Bonded Wearing Course mixture shall be applied at the rate per square yard as shown in TABLE 3 for the mix type shown in the plans or typical sections, or as directed by the Engineer.

The Polymer-Modified Emulsion Membrane shall be sprayed at a temperature of 140 - 180°F (60-80°C). The sprayer system shall accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid. The rate of application (typically 0.15 to 0.25 gal/yd²) shall be determined by the mix design and current pavement condition for the specified project. The rate of application shall be approved by the Engineer prior to beginning work.

No wheel or other part of the paving machine shall come in contact with the Polymer-Modified Emulsion Membrane before the hot mix asphalt concrete wearing course is applied. The application of the HMA shall follow the spray of the Polymer-Modified Emulsion Membrane by no more than 3 seconds.

The hot asphalt concrete wearing course shall be placed over the full width of the polymer-modified emulsion membrane. The hot mix asphalt concrete shall be applied at a temperature of 300 - 330°F (150-165°C) or as approved by the engineer and shall be spread over the polymer-modified emulsion membrane immediately after the application of the membrane. The temperature of the mix at the asphalt plant shall be within $\pm 15^{\circ}\text{F}$ ($\pm 8^{\circ}\text{C}$) of the JMF temperature. The temperature of the mix immediately prior to discharge from the hauling vehicle shall be within $+15^{\circ}\text{F}$ ($+8^{\circ}\text{C}$) to -25°F (-14°C) of the JMF temperature.

Note:

Because of the minimal depth of the hot mix asphalt concrete being placed, it may be damaged if opened to traffic too quickly. Therefore, the new pavement shall not be opened to traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage. The cooling time will be brief due to the minimal depth of the mat.

D. Compaction:

Compaction of the wearing course shall consist of a minimum of two passes with a steel double drum asphalt roller before the material temperature has fallen below 185°F (85°C). At no time shall the roller or rollers be allowed to remain stationary on the freshly placed asphalt concrete. Compaction shall immediately follow the placement of Ultra-thin Bonded Wearing Course. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. Compaction shall be done in the static mode.

QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS:

The Ultrathin Hot Mix Asphalt shall be produced in accordance with the applicable provisions of Section 609 of the Project Special Provisions titled "QMS for ASPHALT PAVEMENTS: (OGAFC, PADC, and ULTRATHIN VERSION)" included herein.

METHOD OF MEASUREMENT:

The quantity of Ultra-thin Hot Mix Asphalt, Type _____ to be paid for will be the actual number of tons of mixture which has been incorporated into the completed and accepted work. The hot mix asphalt pavement will be measured by being weighed in trucks on certified platform scales or other certified weighing devices.

The quantity of Application of Ultra-thin Hot Mix Asphalt to be paid for will be the actual number of square yards of mixture placement which has been completed and accepted. In measuring this quantity, the length will be the actual length constructed, measured along the surface. The width will be the width required by the plans or directed by the Engineer.

The quantity of "Asphalt Binder for Plant Mix, Grade PG 70-28" will be measured in accordance with Section 620-4 of the Standard Specification.

BASIS OF PAYMENT:

The quantity of ultrathin hot mix asphalt, measured as provided above, will be paid for at the contract unit price per ton for "Ultrathin Hot Mix Asphalt, Type _____".

The above price and payment shall include but not be limited to all labor, materials and equipment necessary to produce and deliver the mix, including binder and non-strip additive (if necessary). The unit price bid per ton for Ultrathin Hot Mix Asphalt shall include the asphalt binder. There will be no adjustment of payments due the Contractor due to asphalt binder base price fluctuation.

The quantity of application of ultrathin hot mix asphalt, measured as provided above, will be paid for at the contract unit price per square yard for "Application of Ultrathin Hot Mix Asphalt".

The above prices and payments shall include but not be limited to all traffic control, labor, materials, including the polymer modified asphalt emulsion, equipment necessary to produce and deliver the mix, including anti-strip additive (if necessary), equipment necessary to apply and compact the mix, and maintaining the ultrathin bonded wearing course until final acceptance of the project.

Providing QMS for asphalt pavements will be in accordance with the project special provision entitled "QMS for ASPHALT PAVEMENTS: (OGAFC, PADC, and ULTRATHIN VERSION)" included elsewhere in this provision form.

Payment will be made under :

Ultrathin Hot Mix Asphalt, Type A.....	Ton
Ultrathin Hot Mix Asphalt, Type B	Ton
Ultrathin Hot Mix Asphalt, Type C	Ton
Application of Ultrathin Hot Mix Asphalt.....	Square Yard

QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS: 2-22-00
(OGAFC, PADC, AND ULTRATHIN HMA VERSION)**609-1 DESCRIPTION**

The work covered by this provision consists of the production and construction of Open Graded Asphalt Friction Course, Permeable Asphalt Drainage Course, and/or Ultrathin Hot Mix Asphalt Concrete Wearing Surface, in accordance with a quality management system as described in these specifications. All provisions of Division 6 of the Standard Specifications, except as modified herein, shall apply.

609-2 DESCRIPTION OF RESPONSIBILITIES**(A) Quality Control:**

The Contractor shall provide and conduct a quality control program. A quality control program is defined as all activities, including mix design when applicable, process control inspection, sampling and testing, and necessary adjustments in the process that are related to production of a pavement which meets all requirements of the specifications.

(B) Quality Assurance:

The Department will conduct a quality assurance program. A quality assurance program is defined as all activities, including inspection, sampling, and testing related to determining that the quality of the completed pavement conforms to specification requirements.

609-3 MIX DESIGN/JOB MIX FORMULA REQUIREMENTS

All applicable provisions of Article 610-3 of the Standard Specifications, except as modified below, shall apply.

At least 10 days prior to start of asphalt mix production, the Contractor shall submit in writing a mix design and proposed job mix formula (JMF) for Open Graded Asphalt Friction Course and/or Ultrathin Hot Mix Asphalt Concrete Wearing Course to the Engineer for review and approval. A mix design is not required for Permeable Asphalt Drainage Course; however, a JMF will be required. All mix designs shall be performed and documented in accordance with the most current accepted policies and procedures for the design of the applicable mix. The Department's Materials and Tests Unit may be contacted for these procedures. The mix design(s) shall meet all design requirements prescribed in the contract project special provisions. The JMF will be established and issued by the Engineer upon approval of the mix design.

609-4 FIELD VERIFICATION OF MIXTURE AND JOB MIX FORMULA ADJUSTMENTS

The Contractor shall conduct field verification of the mix at each plant within 7 calendar days prior to beginning production of each new mix. In addition anytime more than a 30 calendar day lapse in quality control testing of any mix has occurred and planned daily production is 80 tons (metric tons) or more, mix verification shall be performed. In addition to the required sampling and testing, all preliminary checks and plant calibrations shall be performed.

Field verification testing shall consist of a minimum of one (1) set of samples tested according to "Required Sampling and Testing" specified in Subarticle 609-5(D). The mix verification sample shall be obtained and split in accordance with current procedures in the HMA/QMS Manual. Normal plant production may begin once all field verification test results have been completed and the mix has been satisfactorily verified by the Contractor's Level II Technician as meeting all applicable individual test control limits as specified in Subarticle 609-5(G), except that the drain down test must meet the requirement for the applicable mix type as specified in the project special provisions. Records of these calibrations and mix verification tests shall be retained by the Contractor and shall be furnished to the Engineer for review and approval within one working day after beginning production of the mix.

If the Contractor and/or the Engineer determine from results of quality control tests conducted during mix verification and/or normal production that adjustments to the JMF are necessary to achieve specified mix properties, adjustments to the JMF may be made within tolerances permitted by specifications for the mix type being produced.

All JMF adjustments will be approved by the Engineer and documented in writing.

Failure by the Contractor to fully comply with the above mix verification requirements shall result in immediate production stoppage by the Engineer. Normal production shall not resume until all mix verification sampling and testing, calibrations, and plant inspections have been performed and approved by the Engineer.

609-5 CONTRACTOR'S QUALITY CONTROL SYSTEM

(A) Personnel Requirements:

The Contractor shall provide at least one certified Asphalt Technician Level I at all times at each plant site used during production of material for the project. A plant operator who is a certified Level I Technician may be utilized to meet this requirement during daily production of less than 80 tons (metric ton). Any absence of the Level I Technician must be pre-approved by the appropriate QA Supervisor. All sampling, testing, data analysis and data posting shall be performed or directly supervised by a certified QMS asphalt technician. The Contractor shall have a certified Asphalt Technician Level II readily available to make any necessary adjustments.

The Contractor shall provide at least one certified QMS Roadway Technician with each paving operation at all times during the placement of asphalt. This person shall be responsible for and directly supervise all roadway paving operations and quality control processes. Certification shall be in accordance with the Department's Asphalt Technician Certification Program.

An organizational chart, including names, telephone numbers and current certification numbers, of all those responsible for the quality control program shall be posted in the Contractor's laboratory while asphalt paving work is in progress.

(B) Field Laboratory Requirements:

The Contractor shall furnish and maintain a Department certified laboratory at the plant site. The laboratory shall include a minimum of 320 square feet (30 square meters) of floor space (exclusive of toilet facilities), equipment, and supplies for performing Contractor quality control testing. Convenient telephone and fax machine access for QMS personnel shall be provided by the Contractor at the plant site.

The laboratory testing equipment shall meet the requirements of the test methods herein identified in Subarticle 609-5(D) "Required Sampling and Testing."

Laboratory equipment furnished by the Contractor or his representative shall be properly calibrated and maintained. The Engineer shall be allowed to inspect measuring and testing devices to confirm both calibration and condition. If at any time the Engineer determines that the equipment is not operating properly or is not within the limits of dimensions or calibration described in the applicable test method, the Engineer may stop production until corrective action is taken. The Contractor shall maintain a record of calibration results at the laboratory.

(C) Quality Control Plan

The Contractor will not be required to submit a written quality control plan to the Department; however, the Contractor shall perform quality control activities required by these specifications and accepted asphalt industry quality control practices and procedures.

(D) Required Sampling and Testing:

The Contractor's Quality Control process shall include, at a minimum but not be limited to, the sampling and testing of all parameters outlined in these provisions using test methods, and frequencies as specified herein. The Contractor shall obtain randomly selected samples in accordance with the latest edition of the Department's "HMA/QMS Manual" except as outlined below for OGAF C Types J-1, J-1 Modified and J-2 Modified. All samples taken shall be logged on forms provided by the Engineer.

All mix samples taken shall be 25 lbs. and must be split and retained in accordance with these procedures, except OGAF C mix samples which shall be a minimum of 1500-2000 gram samples each for QC, QA and retained samples. OGAF C QC samples will be tested immediately. QA and retained samples of OGAF C will be placed in lubricated gill cans and stored for possible testing in accordance with the procedures established below.

The untested split portion of the Contractor's mix samples and tested TSR specimens shall be retained for 5 calendar days at the plant site commencing the day the samples are tested. Permission for disposal may be given by Quality Assurance personnel prior to this maximum storage period. The split portion of the Contractor's mix verification sample(s) shall be retained until either procured by or disposal permission is given by QA personnel. All retained samples shall be stored in a dry and protected location.

The Contractor shall maintain minimum test frequencies as specified below. All tests shall be completed within 24 hours of the time the sample was taken unless otherwise specified within these provisions. Should the specified tests not be completed within the required time frame, production will cease at that point until such time the tests are completed.

The Contractor may utilize innovative equipment or techniques not addressed by these specifications to produce and/or monitor the production of the mix, subject to approval by the Engineer.

Should the Contractor's testing frequency fail to meet the minimum frequency requirements as specified below, all mix without the specified test representation shall be considered unsatisfactory. If the Engineer allows the mix to remain in place, payment will be made at 50 percent of the contract unit bid price for the mixture.

QUALITY CONTROL MINIMUM SAMPLING AND TESTING SCHEDULE

Asphalt Mixture - From Truck at Plant (AASHTO T-168)

- A. Asphalt Binder Content, % (Contractor may select any option below)
 - 1. Extraction (AASHTO T-164)
 - 2. Ignition Furnace (NCDOT Procedure)
 - 3. OTHER: Contractor may request to use other means of checking AC Content subject to approval by the Engineer
- B. Aggregate Gradation, Recovered Aggregate from Mix Sample (AASHTO T-30 and T-11) (Shall be graded on all sieves specified on the job mix formula.)

The above testing program shall be conducted for each job mix formula at each plant at a minimum frequency of once per each 500 tons (metric tons) of actual production.

The tests will be conducted at the random locations for materials that are actually produced that day. If production is discontinued and the random sample location for a partially completed increment has not been reached, the tonnage for the partially completed increment shall be carried forward to the next day's production. When total production for three (3) consecutive work days is less than 500 tons (metric tons) a minimum of one sample shall be taken. This sample shall represent the tonnage for those three (3) days. A new 500 ton (metric ton) increment(s) will begin the following work day. All random sample locations, within the above specified increments, will be determined in accordance with the latest edition of the Department's HMA/QMS Manual.

In addition to the above sampling and testing program, the following tests shall be conducted as indicated:

- 1. Aggregate Stockpile Gradations* (AASHTO T-11 and T-27)
(sampled from the stockpiles or cold feed system at beginning of production & weekly thereafter)
- 2. Combined Aggregate Moisture Content (AASHTO T-255)(Drum Plant Only)
(sampled from stockpiles or cold feed system a minimum of once daily)
- 3. Retained Tensile Strength (TSR) - (AASHTO T 283 Modified)

TSR only required for Ultrathin Hot Mix Asphalt Concrete Wearing Course.

Option 1: Mix sampled from truck at plant, tested, and results furnished to the Engineer within the first 7 working days of production of each new mix design. From the above sample QC prepares an additional set of specimens and submits these within 5 calendar days to the QA lab for testing.

Option 2: Mix sampled from the truck at the plant with one set of specimens prepared by the Contractor and tested jointly by QA and QC at a mutually agreed upon lab site. In this case the specimens must be tested on either a recording test press or a test press that maintains the peak load readings after the specimen has broken.

Additional TSR testing, in accordance with the above procedures, required when a change is made in anti-strip additive source or dosage and when deemed necessary by the Engineer. TSR testing not required for mix verification, but may be performed at that time.

5. NCAT Asphalt Drain Down Test Procedure (Copy of procedure may be obtained from the M & T Asphalt Design Engineer.)
Drain Down Test not required for Permeable Asphalt Drainage Course. Mix sampled from truck at plant within the first day's production and weekly thereafter.

*In lieu of aggregate stockpile gradations, the Contractor may furnish gradation quality control data conducted by the aggregate producer, which is representative of the Contractor's current stockpiles.

(E) Documentation (Records):

The Contractor shall document all observations, records of inspection, samples taken, adjustments to the mix, and test results on a daily basis. Results of observations and records of inspection shall be noted as they occur in a permanent field record. Adjustment to mix production and test results shall be recorded on forms provided by the Engineer.

All such records shall be made available to the Engineer, upon request, at any time during project construction. All QC records and forms shall be completed and distributed in accordance with the most current edition of the Department's "HMA/QMS Manual". At the end of the project, a copy of the control charts (with the moving average shown in red) shall be provided to the Engineer in a neat and orderly manner. The QC testing forms shall be maintained by the Contractor for 90 calendar days after project completion.

Failure to maintain QC records and forms as required, or to provide these records and forms to the Engineer upon request, may result in production stoppage until the problem is resolved.

Falsification of test results, documentation of observations, records of inspection, adjustments to the process, discarding of samples and/or test results, or any other deliberate misrepresentation of the facts will result in the revocation of the applicable person's QMS certification. There will be no pay for all tonnage represented by the falsified test(s) results or documentation. The Engineer will determine acceptability of the mix in question. If mix represented by the falsified results is determined not to be acceptable, it shall be removed and replaced with mix which complies with the Specifications.

(F) Documentation (Control Charts):

Standardized control charts furnished by the Department shall be maintained by the Contractor at the field laboratory. All test results obtained by the Contractor shall be recorded on control charts the same day tests are conducted.

Results of quality assurance tests performed by the Engineer will be posted on the Contractor's control charts as data becomes available.

The following data shall be recorded on standardized control charts:

1. Aggregate Gradation Tests
 - A. 1/2"(12.5mm)(Type P57 Only)
 - B. 3/8"(9.75mm)(Excluding Type P57)
 - C. No. 4 (4.75 mm)
 - D. No. 8 (2.36 mm)
 - E. No. 200 (0.075 mm) Sieves
2. Asphalt Binder Content, %

Both the individual test value and the moving average of the last four (4) data points will be plotted on each chart. The Contractor's test data will be shown in black and the moving average in red. The Engineer's assurance data will be plotted in blue. The warning control limits shall be drawn with a dash green line, the JMF control limits with a dash blue line, and individual test limits with a dash red line. Once a moving average has been established for a given JMF, the moving average shall be continuous with the following exceptions. A new moving average shall be re-established when a change in the asphalt cement percentage or aggregate blend is made in the JMF or when the Contractor elects or is required to stop production after one or two moving average values, respectively, fall outside the warning limits as outlined in Subarticle 609-5(I). In addition, if the Contractor fails to stop production after two consecutive moving averages exceed the warning limits, but does stop production at a subsequent time, a new moving average shall be re-established beginning at the actual production stop point. The moving averages for all other mix properties shall also be re-established. Moving averages will not be re-established when production stoppage occurs due to an individual test result exceeding the Specification requirements.

All individual test results shall be part of the plant quality control record and shall be included in moving average calculations with the following exception. When the Contractor's testing data has been proven incorrect, the correct data as determined by the Engineer shall be used in lieu of the Contractor's data to determine the appropriate pay factor in accordance with Subarticle 609-5(I). In this case, only the data in question shall be replaced.

G. Control Limits:

The following shall be considered control limits for mix production. Control limits for the JMF and warning limits are based on a moving average of the last four (4) data points. All control limits will be applied to data given on the current JMF.

<u>Mix Property</u>	<u>Control Limits, %</u>		
	<u>Warning</u>	<u>JMF</u>	<u>Individual Test</u>
½"(12.5mm)Sieve (<u>Type P57 Only</u>)	+/-5.0	+/-6.0	+/-7.0
3/8"(9.5mm) Sieve (<u>Excluding Type P57</u>)	+/-4.0	+/-5.0	+/-6.0
No. 4 (4.75mm)Sieve	+/-4.0	+/-5.0	+/-6.0
No. 8 (2.36 mm) Sieve	+/-3.0	+/-4.0	+/-5.0
No. 200 (0.075 mm) Sieve	+/-1.2	+/-1.6	+/-2.0
Asphalt Binder Content	+/-0.3	+/-0.4	+/-0.5

(H) Warning Bands:

Warning bands are defined as the area between the Warning limits and JMF limits.

(I) Corrective Action:

All corrective actions are based upon initial test results and shall be taken immediately upon obtaining those results.

When an individual test result for a mix control criteria exceeds both the individual test control limits and the applicable specification design limits, or when two consecutive field test TSR values fail to meet the minimum specification requirement, production of that mix shall cease immediately. Normal production of the mix in question shall not resume until approval is given by the Engineer.

Acceptance of all mix failing to meet the individual test control limits or minimum TSR requirements as described above will be determined in accordance with Article 105-3. In addition, any mix which is obviously unacceptable will be rejected for use in the work.

Failure to stop production and make adjustments when required due to an individual test not meeting the specified requirements shall subject all mix from the stop point tonnage to the point when the next individual test is back on or within the warning limits, or to the tonnage point when production is actually stopped, whichever occurs first, to be considered unacceptable.

Failure to stop production when required due to two consecutive TSR tests failing to meet the specification requirement shall subject all mix from the stop point tonnage to the point when the next TSR test meets or exceeds the specification requirement, or to the tonnage point when production is actually stopped, whichever occurs first, to be considered unacceptable.

In either case, this material shall be removed and replaced with materials which comply with the specifications unless otherwise approved by the Engineer.

When the moving average values trend either upward or downward toward the warning limits, the Contractor shall consider taking corrective action. The corrective action, if any, shall be documented. The Contractor shall immediately notify the Engineer whenever moving average values exceed the warning limits.

If two consecutive moving average values for any one of the mix control criteria fall outside the warning limits, the Contractor shall cease production of that mix and make adjustments. The Contractor may elect to stop production after only one moving average value falls outside the warning limits. In either case, a new moving average shall not be determined until the fourth test after the elective or mandatory stop in production. Normal production of the mix in question shall not be resumed until approved by the Engineer.

If the process adjustment improves the property in question such that the moving average after four additional tests is on or within the warning limits, the Contractor may continue production with no reduction in payment.

If the adjustment does not improve the property in question such that the moving average after four additional individual tests stays in the warning bands, the mix shall be considered not to be within reasonably close conformity, but reasonably acceptable. Reduced payment for the mix in question will be applied starting from the plant sample tonnage at the stop point to the sample tonnage when the moving average is on or within the warning limits in accordance with the following table.

Payment for Mix Produced in the Warning Bands

<u>Mix Property</u>	<u>Pay Factor</u> Percent Bid Price for Mix**
1/2"(12.5mm)Sieve (Type P57 Only)	90
3/8" (9.5mm) (Excluding Type P57)	90
No. 4 (4.75mm)	90
No. 8 (2.36mm)	90
No. 200 (0.075mm)	90
Asphalt Binder Content	85

** The minimum single pay factor will apply.

If the adjustment does not improve the property in question such that the moving average after four additional tests exceeds the JMF control limits, the mix shall be considered not to be within reasonably close conformity with specifications. If the Engineer determines the mix is reasonably acceptable based on test data and an inspection of the completed pavement and allows it to remain in place, the mix will be accepted in accordance with Article 105-3.

If the mix is determined to be unacceptable, the mix shall be removed and replaced with materials which comply with the specifications. In either case, the adjustment or removal, respectively, for the mix in question will be applied starting from the plant sample tonnage at the stop point to the sample tonnage when the moving average is on or within the warning limits. In addition, any mix which is obviously unacceptable will be rejected for use in the work.

Failure to stop production and make adjustments as described above due to two consecutive moving average values falling outside the warning limits shall subject all mix produced from the stop point tonnage to the tonnage point when the moving average is back on or within the warning limits, or to the tonnage point when production is actually stopped, whichever occurs first, to be considered unacceptable. This material shall be removed and replaced with materials which comply with the specifications unless otherwise approved by the Engineer.

609-6 QUALITY ASSURANCE

Quality assurance will be accomplished in the following ways:

1. by conducting assurance testing of split samples obtained by the Contractor at a frequency equal to or greater than 10% of the frequency required of the Contractor;
2. by periodically observing tests performed by the Contractor;
3. by monitoring required control charts exhibiting test results of control parameters;
4. by directing the Contractor to take additional samples at any time and any location during production (in lieu of the next scheduled random sample) and;
5. by conducting verification sampling and testing on samples taken independently of the Contractor's quality control samples; and
6. by any combination of the above

In all cases, the Engineer's quality assurance and verification testing will be independent of the Contractor's tests. The Department's quality assurance program will be conducted by a certified QMS technician(s).

The Engineer will conduct assurance tests on split samples taken by the Contractor for quality control testing. These samples may be the regular quality control samples or a sample selected by the Engineer from any location in the process. The frequency will be equal to or greater than 10% of that required of the Contractor as stated in Subarticle 609-5(D), "Required Sampling and Testing". The Engineer may select any or all split samples for assurance testing. Results of quality assurance tests will be provided to the Contractor within 3 working days after the sample has been obtained, except for verification TSR test results which will be provided within 7 calendar days.

Differences between the Contractor's and the Department's split sample test results will be considered acceptable if within the following limits:

<u>Mix Property</u>	<u>Acceptable Limits of Precision</u>
1/2"(12.5mm)Sieve (Type P57 Only)	±7.0 %
3/8"(9.5mm)Sieve (Excluding Type P57)	±6.0 %
No. 4 (4.75 mm) Sieve	±5.0 %
No. 8 (2.36 mm) Sieve	±5.0 %
No. 200 (0.075 mm) Sieve	±2.0 %
Asphalt Binder Content	±0.5 %
TSR (Ultrathin HMA Only)	±15.0 %

In the event comparison test results are outside the above acceptable limits of precision, or the quality assurance test results are either outside the individual test control limits or fail to meet Specification requirements, the Engineer will immediately investigate the reason for the difference.

If the potential for a pavement failure is present, the Engineer may suspend production, wholly or in part, in accordance with Article 108-7 while the investigation is in progress. The Engineer's investigation may include but not limited to:

1. Joint testing of any remaining split samples,
2. Review and observation of the QC Technician's sampling and testing procedures,
3. QC equipment, and
4. Comparison of split sample test results on mix currently being produced.

If reasons for the difference cannot be determined, payment for the mix in question will be determined in accordance with Article 105-3.

The Engineer will periodically witness the sampling and testing being performed by the Contractor. If the Engineer observes that the sampling and quality control tests are not being performed in accordance with the applicable test procedures, the Engineer may stop production until corrective action is taken. The Engineer will promptly notify the Contractor of observed deficiencies, both verbally and in writing. The Engineer will document all witnessed samples and tests.

The Engineer will obtain verification samples for testing independent of the Contractor's quality control process. These samples will be split for testing by the Engineer and the Contractor.

609-7 ACCEPTANCE

The Engineer will base final acceptance of the mix on the results of random testing made on split samples during the assurance process and validation of the Contractor's quality control process as outlined in Subarticle 609-5(I) and Article 609-6.

609-8 COMPENSATION

The production and construction of all asphalt mixtures and pavements shall be performed in accordance with these provisions. There will be no direct payment for this work. Payment at the contract unit prices for the various asphalt items will be full compensation for all work covered by this provision.

ASPHALT BINDER CONTENT OF ASPHALT PLANT MIXES:**1-01-02_R**

The approximate asphalt binder content of the asphalt concrete plant mixtures used on this project will be as follows:

Asphalt Concrete Base Course, Type B 25.0_	4.3%
Asphalt Concrete Intermediate Course, Type I 19.0_	4.7%
Asphalt Concrete Surface Course, Type S 4.75A	7.0%
Asphalt Concrete Surface Course, Type SF 9.5A	6.5%
Asphalt Concrete Surface Course, Type S 9.5_	6.0%
Asphalt Concrete Surface Course, Type S 12.5_	5.5%

The actual asphalt binder content will be established during construction by the Engineer within the limits established in the Standard Specifications or Project Special Provisions.

RR43

RESURFACING EXISTING BRIDGES:**7-1-95**

The Contractor's attention is directed to the fact that he will be required to resurface the bridges on this project if directed by the Engineer.

Place the surface so as to follow a grade line set by the Engineer with the minimum thickness as shown on the sketch herein or as directed by the Engineer. State Forces will make all necessary repairs to the bridge floors prior to the time that the Contractor places the proposed surfacing. Give the Engineer at least 15 days notice prior to the expected time to begin operations so that State Forces will have sufficient time to complete their work.

At all bridges which are not to be resurfaced, taper out the proposed resurfacing layer adjacent to the bridges to insure a proper tie-in with the bridge surface.

RR61

**ASPHALT CONCRETE SURFACE COURSE, TYPE --
(LEVELING COURSE):****7-1-95**

Place a leveling course of Asphalt Concrete Surface Course, Type ____ at locations shown on the sketch maps and as directed by the Engineer. The rate of this leveling course is not established but will be determined by allowing the screed to "drag" the high points of the section. It is anticipated that some map numbers will be leveled from beginning to end while others may only require a leveling course for short sections.

The Asphalt Concrete Surface Course, Type __ (Leveling Course) shall meet the requirements of Section 610 of the Standard Specifications except payment will be made at the contract unit price per ton for "Asphalt Concrete Surface Course, Type __ (Leveling Course)".

RR85

PATCHING EXISTING PAVEMENT:**1-15-02****Description:**

The Contractor's attention is directed to the fact that there are areas of existing pavement on this project that will require repair prior to resurfacing.

Patch the areas that, in the opinion of the Engineer, need repairing. The areas to be patched will be delineated by the Engineer prior to the Contractor performing repairs.

Construction Methods:

The patching consists of Asphalt Concrete Base Course, Asphalt Concrete Intermediate Course, Asphalt Concrete Surface Course, or a combination of base, binder and surface course, and pavement removal, as directed by the Engineer.

Patching of existing pavement includes but is not limited to the cutting of the existing pavement to a neat vertical joint and uniform line; the removal and disposal of pavement, base, and subgrade material as approved or directed by the Engineer; the coating of the area to be repaired with a tack coat; and the replacement of the removed material with asphalt plant mix.

Place Asphalt Concrete Base Course, in lifts not exceeding 5 1/2 inches. Utilize compaction equipment suitable for compacting patches as small as 3.5 feet by 6 feet on each lift. Use an approved compaction pattern to achieve proper compaction. If patched pavement is to be open to traffic for more than 48 hours prior to overlay, then use Asphalt Surface Course in the top 1.25 inches of the patch.

Remove existing pavement at locations directed by the Engineer in accordance with Section 250 of the Standard Specifications.

Schedule operations so that all areas where pavement has been removed will be repaired on the same day of the pavement removal, and all lanes of traffic restored.

Method of Measurement:

The quantity of patching existing pavement to be paid for will be the actual number of tons of asphalt plant mix, complete in place, which has been used to make completed and accepted repairs. The asphalt plant mixed material will be measured by being weighed in trucks on certified platform scales or other certified weighing devices.

Basis of Payment:

The quantity of patching existing pavement, measured as provided above, will be paid for at the contract unit price per ton for "Patching Existing Pavement".

The above price and payment will be full compensation for all work covered by this provision, including but not limited to removal and disposal of pavement; furnishing and applying tack coat; furnishing, placing, and compacting of asphalt plant mix; furnishing of asphalt binder for the asphalt plant mix; and furnishing scales.

Any provisions included in the contract in the form of project special provisions or in any other form which provide for adjustments in compensation due to variations in the price of asphalt binder will not be applicable to payment for the work covered by this provision.

The item of "Patching Existing Pavement" will be considered to be a minor item. In the event that the item of "Patching Existing Pavement" overruns the original bid quantity by more than 100 percent, the provisions of Article 104-5 pertaining to revised contract unit price for overrunning minor items will not apply to this item.

RR88

Payment will be made under:

Patching Existing Pavement Ton

AGGREGATE PRODUCTION:

11-20-01

Provide aggregate from a producer who utilizes the new Aggregate Quality Control/Quality Assurance Program which is in effect at the time of shipment.

No price adjustment is allowed to contractors or producers who utilize the new program. Participation in the new program does not relieve the producer of the responsibility of complying with all requirements of the Standard Specifications. Copies of this procedure are available upon request from the Materials and Test Unit.

RR109

DRUMS:

07-16-02

Revise the 2002 Standard Specifications as follows:

Page 10-195, Subarticle 1089-5(C)

Delete the first (1st) sentence of the first (1st) paragraph and insert the following:

“Provide a minimum of three orange and two white alternating horizontal circumferential stripes covering the entire outside with each drum.”

RR116

REMOVAL OF EXISTING PAVEMENT MARKERS:**7-1-95**

The Contractor's attention is directed to the fact that there are pavement markers on this project.

Remove and dispose of these markers prior to the paving operation.

No direct payment will be made for this work, as it will be incidental to the paving operation and payment at the contract unit price for the various asphalt items in the contract will be full compensation for such work.

RR118

PAVEMENT MARKING GENERAL REQUIREMENTS:**07-16-02**

Revise the 2002 Standard Specifications as follows:

Page 12-10, Subarticle 1205-3(J)

Delete the first (1st) sentence of the first (1st) paragraph and insert the following:

“Have at least one member of every pavement marking crew working on a project certified through the NCDOT Pavement Marking Technician Certification Process. For more information contact the Traffic Control, Marking and Delineation Section of the North Carolina Department of Transportation at 919-250-4151 or <http://www.doh.dot.state.nc.us/preconstruct/traffic/congestion/TC/>”

RR119